



Mail Stop Appeal Brief

PATENT

Customer Number 22,852
Attorney Docket No. 04329.2222

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re Application of:)
Kouji MATSUO, et al.) Group Art Unit: 2814
Serial No.: 09/492,780) Examiner: Rao, Shrinivas H.
Filed: January 28, 2000)
For: SEMICONDUCTOR DEVICE AND)
METHOD OF MANUFACTURING)
THE SAME)

Mail Stop Appeal Brief - Patents

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPEAL BRIEF

Pursuant to 37 C.F.R. § 1.192, Appellants submit this Appeal Brief to the Board of Appeals and Interferences, in triplicate, and accompanied by a check in the amount of \$320.00 to satisfy the fee under 37 C.F.R. § 1.17(c). This Appeal is from the Final Office Action of April 23, 2003. Appellants filed a Notice of Appeal on July 23, 2003, and accordingly, submission of this Appeal Brief on September 23, 2003 is timely.

I. Real Party in Interest

The real party in interest is Kabushiki Kaisha Toshiba, a corporation of Japan, by virtue of an assignment that was recorded on January 28, 2000, at Reel 010537, starting at Frame 0894.

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II. Related Appeals and Interferences

There are currently no known Appeals or Interferences related to this application that are awaiting decision by the Board of Patent Appeals and Interferences.

III. Status Of Claims

Claims 1 – 20 are pending in this application, with claims 1 – 11, 19, and 20 withdrawn from consideration as drawn to a nonelected invention. For the purposes of this Appeal Brief, claims 12 – 16 have been rejected under 35 U.S.C. § 112, first paragraph; 35 U.S.C. § 112 second paragraph; and 35 U.S.C. § 103(a). Claims 17 and 18 are allowed. Claims 12 – 16, on appeal, are set forth in an attachment entitled “Appendix A.”

IV. Status Of Amendments

Appellants filed an Amendment on January 30, 2003. In a Final Office Action, dated April 23, 2003, the Examiner repeated the rejections of claims 12 – 16. The claims have been amended during prosecution of the present application, and all amendments submitted have been entered.

V. Summary Of Invention

The present invention relates to a semiconductor device, particularly to improvements made to a gate insulating film in a semiconductor device. *See* Appellants’ specification, page 1, lines 12 – 15. The present invention provides a semiconductor device with an improved gate insulating film included in a metal-insulator-semiconductor (MIS) type transistor. *See* Appellants’ specification, page 37, lines 1 – 5.

According to a disclosed embodiment, the improved gate insulating film has a structure consisting of a plurality of first insulating regions (71), formed of grains containing a metal oxide, and a second insulating region (72), formed of an amorphous insulating material,

surrounding the plurality of first insulating regions (71), such that crystal grains constituting first insulating regions (71) are not brought into direct contact with each other. The plurality of first insulating regions (71) are separated by a matrix of second insulating region (72). *See* Appellants' specification, page 37, line 6 to page 38, line 7. *See also* Appellants' Figs. 6A and 6B.

As such, the semiconductor device of the present invention comprises a semiconductor substrate and a metal-containing insulating film formed directly or indirectly on the semiconductor substrate. This metal-containing insulating film includes a plurality of first insulating regions, each of which is formed of a grain containing a metal oxide. This metal-containing insulating film also includes a second insulating region formed of an amorphous insulating material. Each of the first insulating regions are formed in the second insulating region. To form an electrical contact with the semiconductor device, an electrode is formed on the metal-containing insulating film. *See* Appellants' claim 12.

Prior to the present invention, however, high dielectric-constant materials, such as TiO₂, have been used for gate insulating films. The formation of these films produces a layer containing clear crystal grain boundaries in contact with adjacent crystal grains. Contact between these crystal grains at the grain boundaries markedly deteriorate the insulating properties of the TiO₂ gate insulating film. *See* Appellants' specification, page 1, lines 16 – 26, and page 2, line 14 to page 3, line 17.

The present invention, as described above, obviates these problems of the prior art.

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VI. Issues

A. Whether claims 12 – 16 define patentable subject matter under 35 U.S.C. § 112, first paragraph.

B. Whether claims 12 – 16 define patentable subject matter under 35 U.S.C. § 112, second paragraph.

C. Whether claims 12 – 16 define patentable subject matter under 35 U.S.C. § 103(a) over Hu, et al. (U.S. Patent No. 5,962,904) and Wittmer, et al., Oxidation Kinetics of TiN Thin Films, J. Appl. Phys. 52(11), pp. 6659 – 6664 (1981), and further in view of Nakajima, et al. (U.S. Patent No. 5,907,188).

VII. Grouping Of Claims

Claims 12 – 16, at issue in “Section VI” above, stand or fall together.

VIII. Argument

A. Claims 12 – 16 define patentable subject matter under 35 U.S.C. § 112, first paragraph.

The Examiner rejected claims 12 – 16 under 35 U.S.C. § 112, first paragraph, for allegedly containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention.

Appellants submit that the rejection of claims 12 – 16 under 35 U.S.C. § 112, first paragraph, should be reversed because Appellants’ subject matter has a complete and clear description in the specification in such a way as to convey to one of ordinary skill in the art that Appellants had possession of the claimed invention at the time the application was filed.

Appellants respectfully direct the Board’s attention to the specification, for example, Figs. 6A and 6B, and page 37, line 1 to page 38, line 7, providing direct support for the recitations of Appellants’ claim 12. These parts of the application clearly show support for the

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language of claim 12, showing “each of said first insulating regions [71] being formed in said second insulating region [72]” (claim 12).

Appellants submit that the Examiner is misinterpreting Appellants’ claimed invention. The Examiner pointed to Appellants’ specification, page 4, lines 8 – 15 and 20 – 26 to “state that the second insulating region is formed in a region except the first insulating region (emphasis supplied) therefore the specification as originally filed does not support the present recitation of, “each of said first insulating regions being formed in said second insulating region.”” (April 23, 2003 Office Action, pp. 2 – 3).

Contrary to the Examiner’s assertions, Appellants note that their specification and claim language are mutually consistent. For example, Appellants’ Figs. 6A and 6B (and the corresponding description on page 37, line 1 to page 38, line 7) clearly show an insulating film 70. This insulating film 70 comprises first insulating regions 71 and a second insulating region 72. Figs. 6A and 6B clearly show first insulating regions 71 formed in second insulating region 72, as all of the crystal grains of first insulating regions 71 are situated in, and surrounded by, second insulating region 72. (*See also*, for example, Appellants’ claim 12). In addition, these Figures also clearly show that second insulating region 72 is in a region except first insulating regions 71 (*See*, for example, the specification at page 4, lines 8 – 15 and 20 – 26), as second insulating region 72 is situated around first insulating regions 71, and therefore is not situated in the regions encompassed by first insulating regions 71.

Appellants submit that the previous paragraph illustrates two different ways of providing support for Appellants’ claimed invention to one of ordinary skill in the art. The Examiner appears to interpret these descriptions differently, as either inconsistent or mutually exclusive. Appellants submit that the Examiner is not looking at Appellants’ claimed invention as a whole,

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and is focusing on only one area of the invention to the exclusion of other parts that would enable one of ordinary skill in the art to appreciate the invention. Appellants also submit the Examiner is instead confusing “the second insulating region is formed in a region except the first insulating regions” (specification, page 4, lines 8 – 15 and 20 – 26) and “each of said first insulating regions being formed in said second insulating region” (claim 12, Figs. 6A and 6B, and specification, page 37, line 1 to page 38, line 7). As described above, Appellants’ present invention clearly discloses, as illustrated in Figs. 6A and 6B, for example, that second insulating region 72 is formed in a region except first insulating regions 71, otherwise, there would be no room for regions 71 and 72 to co-exist in insulating film 70. Similarly, each of first insulating regions 71 is formed in second insulating region 72, as shown in Figs. 6A and 6B, otherwise insulating film 70 would not include regions 71 and 72. Thus, the claim language “each of said first insulating regions being formed in said second insulating region” is clearly depicted in Figs. 6A and 6B, as is the specification language “the second insulating region is formed in a region except the first insulating regions.” These are two different ways of describing the same feature of the present invention.

Appellants respectfully point out to the Board that: “[p]rior to determining whether the disclosure satisfies the written description requirement for the claimed subject matter, the examiner should review the claims and the entire specification . . . *to understand how [Appellant] provides support for the various features of the claimed invention.*” M.P.E.P. § 2163(II)(A)(2), italics added, citations omitted. See also M.P.E.P. § 2163.02 (“An [Appellant] shows possession of the claimed invention by *describing the claimed invention* with all of its limitations *using such descriptive means as words, structures, figures, diagrams, and formulas* that fully set forth the claimed invention,” italics added).

Appellants submit that for the reasons presented above, the language of claim 12 and the corresponding description in the specification clearly indicates Appellants' possession of the claimed invention to satisfy the requirements of 35 U.S.C. § 112, first paragraph. Appellants submit that all subject matter in "the specification conveys with a reasonable clarity to those skilled in the art that, as of the filing date sought, [Appellants were] in possession of the invention as now claimed" (M.P.E.P. § 2163), and that Appellants have fully satisfied their burden to "show support in the original disclosure for the new or amended claims" (*Id.*).

Claim 12 fully complies with the requirements of 35 U.S.C. § 112, first paragraph, and Appellants accordingly request the Examiner's rejection be reversed. Claims 13 – 16 also comply with 35 U.S.C. § 112, first paragraph, as they are dependent from base claim 12.

In making various references to the specification and drawings set forth herein, it is understood that Appellants are in no way intending to limit the scope of the claims to the exemplary embodiments described in the specification and illustrated in the drawings. Rather, Appellants expressly affirm that they are entitled to have the claims interpreted broadly, to the maximum extent permitted by statute, regulation, and applicable case law.

B. Claims 12 – 16 define patentable subject matter under 35 U.S.C. § 112, second paragraph.

Appellants submit that the rejection of claims 12 – 16 under 35 U.S.C. § 112, second paragraph, should be reversed because Appellants have particularly pointed out and distinctly claimed the subject matter Appellants regard as the invention. Appellants submit that the Examiner has not treated Appellants' previous arguments and amendments on the merits, and has merely repeated the rejection in the Final Office Action.

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Regarding the rejection of claim 12 under 35 U.S.C. § 112, second paragraph, the Examiner stated “the proper placement and relationship between the second insulating region and the other elements may be recited to over come this rejection” (November 4, 2002 Office Action, p. 4). In response, Appellants amended claim 12 (in the January 30, 2003 Amendment) to recite “a second insulating region formed of an amorphous insulating material, each of said first insulating regions being formed in said second insulating region,” thereby reciting placement and relationship between the second insulating region and the other elements.

Appellants submit that this rejection was overcome at the time of the January 30, 2003 Amendment, and that the Examiner repeated this rejection in the April 23, 2003 Office Action as a corollary to the 35 U.S.C. § 112, first paragraph, rejection (*See* April 23, 2003 Office Action, page 4, line 6), without giving full consideration on the merits to Appellants’ arguments and amendments.

Appellants submit that claims 12 – 16 fully comply with the requirements of 35 U.S.C. § 112, second paragraph, and Appellants accordingly request the Examiner’s rejection be reversed.

C. Claims 12 – 16 define patentable subject matter under 35 U.S.C. § 103(a).

Appellants submit that the rejection of claims 12 – 16, based on 35 U.S.C. § 103(a), should be reversed because the Examiner has failed to establish *prima facie* obviousness.

Appellants respectfully disagree with the Examiner’s arguments and conclusions, and submit that a *prima facie* case of obviousness has not been established, and do not concede the Examiner’s claim that he “has established *prima facie* obviousness beyond a shadow of doubt” (April 23, 2003 Office Action, page 8).

In order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim elements. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine reference teachings. Third, there must be a reasonable expectation of success. *See M.P.E.P. § 2143.*

The Examiner does not show that all the elements of Appellants' claims are met in the cited references, does not show that there is any suggestion or motivation to modify the cited references to result in the claimed invention, and does not show there would be any reasonable expectation of success from so doing.

Prior Art Reference Must Teach or Suggest All the Claim Elements

Appellants dispute the Examiner's contention that Hu in view of Wittmer and Nakajima teach or suggest each and every element of Appellants' claimed invention.

To begin, Appellants respectfully point out to that it "is *impermissible* within the framework of section 103 *to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary* to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." *See In re Wesslau*, 147 U.S.P.Q. 391 (C.C.P.A. 1965), emphasis added. *See also M.P.E.P. § 2141.02.* Appellants submit that, for the reasons detailed below, the Examiner is only using so much of the cited references to support the Examiner's position, to the exclusion of other parts necessary to give a full appreciation of what the references fairly suggest to one of ordinary skill in the art.

Appellants' independent claim 12 recites, among other things,

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“...a metal-containing insulating film formed directly or indirectly on said semiconductor substrate, said metal-containing insulating film including a plurality of first insulating regions each of which is formed of a grain containing a metal oxide and a second insulating region formed of an amorphous insulating material, each of said first insulating regions being formed in said second insulating region...”

To explain how Appellants' claimed invention is distinguishable from Hu, Wittmer, and Nakajima, Appellants raise the following points.

Hu and/or Wittmer do not teach or suggest at least these recitations of Appellants' claim

12. In contrast, Hu discloses a 9 nm gate oxide layer 14, poly-Si layer 16, electrically conductive Si material (preferably refractory metal Si-nitride and also amorphous (Hu, col. 5, lines 59-60)) as a diffusion barrier 18, a W / W_xSi_y electrode layer 20, and a cap 34. Hu's physical vapor deposition deposits “a layer of substantially amorphous refractory metal silicide nitride material” (Hu, col. 5, lines 59-60), which does not contain “a plurality of first insulating regions each of which is formed of a grain containing a metal oxide and a second insulating region formed of an amorphous insulating material” (claim 12). Wittmer teaches TiN and Titanium oxides (See Wittmer, Table I). Though his TiN and oxidized TiN have “small grain size” (See Wittmer, “Conclusions,” page 6663), Wittmer does not teach or suggest “...a metal-containing insulating film formed directly or indirectly on said semiconductor substrate, said metal-containing insulating film including a plurality of first insulating regions each of which is formed of a grain containing a metal oxide and a second insulating region formed of an amorphous insulating material, each of said first insulating regions being formed in said second insulating region...” (claim 12).

While the Examiner admitted that “Hu and Wittmer do not specifically describe the limitation[, “[i]ncluding a plurality of first insulating regions each of which is formed of a grain containing a metal oxide[”]” (April 23, 2003 Office Action, p. 5), the combination of Hu with Nakajima still does not teach or suggest at least the recitations of Appellants’ claim 12, as discussed above. Nakajima only teaches laminated layers as a diffusion barrier (*See* Nakajima, col. 32, lines 37-50). Likewise, Nakajima also fails to teach or suggest Appellants’ claimed “metal-containing insulating film … including a plurality of first insulating regions each of which is formed of a grain containing a metal oxide and a second insulating region formed of an amorphous insulating material, each of said first insulating regions being formed in said second insulating region…” (claim 12). Nakajima merely discloses insulating layers formed during device fabrication processes (none of which are labeled “first insulating regions”), and discloses nothing regarding the contents of grains in an insulating region as Appellants have recited in their claim.

Thus, it is clear that Hu, Wittmer, and Nakajima, taken alone or in combination, do not teach or suggest all of the recitations of Appellants’ claim 12.

The above clearly demonstrates how Hu, Wittmer, and Nakajima are different from the present invention as claimed. Since the deficiencies of Hu, Wittmer, and Nakajima actually compound, Hu, Wittmer, and Nakajima, taken alone or in combination, still do not combine to teach or suggest at least the above-quoted elements of Appellants’ independent claim 12. Appellants therefore submit that the Examiner is using only so much of the cited references that will support the Examiner’s position to the exclusion of other necessary parts to enable one of ordinary skill in the art to fully appreciate it.

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This conclusively demonstrates just some of the differences between Hu, Wittmer, and Nakajima, and Appellants' present claimed invention. The Examiner has therefore not met at least one of the essential criteria for establishing a *prima facie* case of obviousness, wherein "the prior art reference (or references when combined) must teach or suggest all the claim limitations." See M.P.E.P. §§ 2142, 2143, and 2143.03.

Suggestion or Motivation to Modify or Combine Reference Teachings

The M.P.E.P. sets forth:

"However, "The mere fact that a worker in the art could rearrange the parts of the reference device to meet the terms of the claims on appeal is not by itself sufficient to support a finding of obviousness. *The prior art must provide a motivation or reason for the worker in the art, without the benefit of appellant's specification, to make the necessary changes* in the reference device." *Ex parte Chicago Rawhide Mfg. Co.*, 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984)." M.P.E.P. § 2144.04, italics added.

As such, the present invention, as recited in independent claim 12, cannot be attained based merely on Hu, or on a combination of Hu with either or both of Wittmer and Nakajima. One skilled in the art would only arrive at the present claimed invention by consulting Appellants' disclosure. Therefore, the only way to construct the claimed invention from the cited references would be to rely on aspects related to the present invention. Such reliance, however, would constitute improper hindsight reasoning. Appellants submit that these references actually diverge from each other in aim and scope, and therefore also teach away from the present invention.

First, Appellants have already demonstrated that a worker in the art would not have been able to combine parts of Hu, Wittmer, and Nakajima to produce Appellants' claimed invention,

and the combination of these references still would not teach or suggest at least the above-quoted elements of Appellants' independent claim 12. Second, Appellants have also demonstrated that the cited references teach away from the present invention since their methodology diverges, and therefore they cannot provide any motivation or reason for one of ordinary skill in the art to modify the references, or combine them, to produce the present claimed invention. Third, Appellants note that one of ordinary skill in the art must have this motivation or reason *without the benefit of Appellants' specification* to modify the references.

As already demonstrated, such combination of these references *a priori* fails to establish obviousness of the claimed invention. Furthermore, Appellants have pointed out deficiencies in the cited prior art that render nugatory any indication that the cited references would give any motivation or reason to one of ordinary skill in the art to modify them *without the benefits of Appellants' specification*. Therefore, Appellants submit that Hu, Wittmer, and Nakajima do not suggest the desirability of any modification to result in Appellants' claimed invention, since their combination still does not produce Appellants' present claimed invention.

Appellants remind the Examiner that determinations of *prima facie* obviousness must be supported by a finding of "substantial evidence." See *In re Zurko*, 258 F.3d 1379, 1386 (Fed. Cir. 2001). Specifically, unless "substantial evidence" found in the record supports the factual determinations central to the issue of patentability, including motivation, the rejection is improper and should be withdrawn.

The Examiner alleged "[t]he motivation to combine the references as previously stated is Hu/Wittmer both describes FetS/ MOS and it is well known that CMOS (Nakajima) is formed from FETS namely NMOS and PMOS" (April 23, 2003 Office Action, page 8).

In this case, Appellants submit the that there is no “substantial evidence” in the record to support the combination of Hu, Wittmer, and Nakajima, and the requisite “clear and particular” motivation required to support a *prima facie* case of obviousness is lacking. The Examiner merely provides a limitation-by-limitation analysis, attempting to point out where the references teach the individual limitations, but fails to provide more than conclusory statements supporting a motive for choosing Appellants’ claimed combination. (*See* April 23, 2003 Office Action, pp. 4 – 5). For example, the Examiner alleges: “it would have been obvious to one of ordinary skill in the art at the time of the invention to include Nakajima’s plurality of first insulating regions each of which is formed of a grain containing a metal oxide in Hu and Wittmer’s device to form a CMOS.device” (April 23, 2003 Office Action, page 5). Recall that Appellants have already established that Nakajima does not teach or suggest “a plurality of first insulating regions each of which is formed of a grain containing a metal oxide.” So, even if Nakajima’s disclosure were to be combined with Hu and/or Wittmer, whether or not this forms a CMOS device, it still would not produce Appellants’ *claimed* invention.

Therefore, in light of the deficiencies of Hu, Wittmer, and Nakajima, discussed previously, Appellants submit that the Examiner points to no evidence supporting the notion that a skilled artisan having Hu before him/her would have been motivated to combine Hu with Wittmer and Nakajima to produce Appellants’ present claimed invention. For at least these reasons, the Examiner fails to meet the burden for establishing a *prima facie* case of obviousness.

Reasonable Expectation of Success Required for Prima Facie Obviousness

In addition, regarding the required reasonable expectation of success, as evidenced from previous arguments regarding Hu, Wittmer, and Nakajima’s disclosures, Appellants submit that there would be no reasonable expectation of success to be derived from modifying Hu with

either or both of Wittmer and Nakajima, as this would diverge at least from Appellants' claimed “... metal-containing insulating film including a plurality of first insulating regions each of which is formed of a grain containing a metal oxide and a second insulating region formed of an amorphous insulating material, each of said first insulating regions being formed in said second insulating region ...” (claim 12). This also demonstrates that the Examiner's reliance on Hu, Wittmer, and Nakajima is not sufficient to establish *prima facie* obviousness.

As further evidence of the impropriety of a combination of Hu, Wittmer, and Nakajima (thus demonstrating additional lack of motivation to combine, and that there is no reasonable expectation of success resulting from combining these references), Appellants point out that their claimed metal-containing insulating film includes a plurality of first insulating regions and a second insulating region. Each of the first insulating regions is formed of a grain containing a metal oxide. The metal oxide has a high dielectric constant, thus increasing the dielectric constant of the metal-containing insulating film. If the metal-containing insulating film were formed only of grains of metal oxide, leakage current would flow along the grain boundary. However, in the present invention, the second insulating region is formed of an amorphous insulating material, and each of the first insulating regions is formed in the second insulating region. The first insulating regions are therefore isolated from each other by the second insulating region, thus preventing the above leakage current. In contrast, Hu, Wittmer, and Nakajima each simply disclose a structure of stacked films, as pointed out previously. Therefore, these references, taken singly or together, do not produce the claimed device of the present invention, and would not give one of ordinary skill in the art a reasonable expectation of success derived from a combination of these references.

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Since Appellants have already demonstrated: (1) deficiencies in the cited references, (2) that they are not combinable to produce the present claimed invention, (3) that they teach away from the present invention, and (4) that they do not provide any suggestion or motivation to produce the present claimed invention, it logically flows that there would be no reasonable expectation of success expected by one of ordinary skill in the art when combining Hu, Wittmer, and Nakajima.

Conclusion:

In summary, the Examiner has not met any of the essential criteria for establishing a *prima facie* case of obviousness. Appellants have demonstrated above that the Examiner: (a) has not shown that all recitations of Appellants' claimed invention are taught or suggested by Hu, Wittmer, and Nakajima; (b) has not shown any requisite suggestion or motivation to modify Hu, Wittmer, or Nakajima to produce Appellants' claimed invention; and (c) has not shown there would be any reasonable expectation of success from modifying Hu, Wittmer, or Nakajima in order to produce the present claimed invention. Thus, Appellants submit that the Examiner's reliance on these references fails to establish *prima facie* obviousness.

Finally, Appellants note that the M.P.E.P. sets forth that “[i]f an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious.” M.P.E.P. § 2143.03. Therefore, Appellants submit that independent claim 12 is allowable, for the reasons argued above. In addition, dependent claims 13 – 16 are also allowable at least by virtue of their dependence from allowable base claim 12.

As such, “[i]n the absence of a proper *prima facie* case of obviousness, an Appellant who complies with the other statutory requirements is entitled to a patent. ... On appeal to the Board,

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an Appellant can overcome a rejection by showing insufficient evidence of *prima facie* obviousness..." *In re Rouffet*, 47 USPQ2d 1453, 1455 (Fed. Cir. 1998).

For all the reasons advanced above, Appellants respectfully request that the Board overturn the improper 35 U.S.C. § 103(a) rejection, and permit allowance of all the rejected claims.

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IX. Appendix

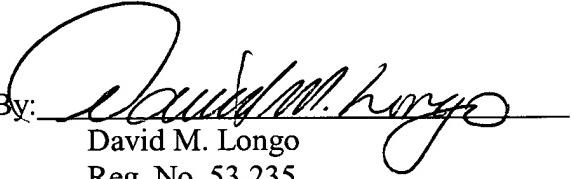
Attached Appendix A contains a clean copy of claims 12 – 16 involved in this appeal.
Please grant any extensions of time required to enter this Appeal Brief and charge any additional fees required to our Deposit Account No. 06-0916.

Respectfully submitted,

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Dated: September 23, 2003

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"APPENDIX A" TO APPEAL BRIEF OF September 23, 2003

12. A semiconductor device, comprising:
 - a semiconductor substrate;
 - a metal-containing insulating film formed directly or indirectly on said semiconductor substrate, said metal-containing insulating film including a plurality of first insulating regions each of which is formed of a grain containing a metal oxide and a second insulating region formed of an amorphous insulating material, each of said first insulating regions being formed in said second insulating region; and
 - an electrode formed on said metal-containing insulating film.
13. The semiconductor device according to claim 12, wherein said first insulating region contains a crystal of said metal oxide, and said second insulating region contains silicon, oxygen and a metal forming said metal oxide.
14. The semiconductor device according to claim 12, wherein said first insulating region contains a crystal of said metal oxide, and said second insulating region contains oxygen and a second metal element differing from a first metal element forming said metal oxide.
15. The semiconductor device according to claim 12, wherein said first insulating region is formed of crystal grains of said metal oxide, and said second insulating region is formed of an amorphous region of said metal oxide.

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16. The semiconductor device according to claim 12, wherein said metal-containing insulating film includes at least one surface which is covered with a covering insulating region made of the amorphous insulating material.

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